Chapter 2

DESCRIPTION OF THE WATER BODY

INTRODUCTION

The St. Lucie Estuary (SLE) and its watershed are located on the southeast coast of Florida in Martin and St. Lucie counties. The SLE watershed encompasses about 781 square miles and is divided into five major basins and several small basins (**Figure 2-1**). The western basins are predominantly agricultural with about 70 percent of land in citrus and improved pasture. The two eastern basins (North St. Lucie and Tidal) are more urban with about 45 percent of the land devoted to agricultural activities. The St. Lucie Canal (C-44), along with the Caloosahatchee River (C-43) are important components of the Central and Southern Florida (C&SF) Project and are used primarily for water releases from Lake Okeechobee when lake levels exceed United States Army Corps of Engineers (USACE) regulation schedules (USACE 2000a) established for flood protection. In addition to regulatory discharges for flood protection, the river and estuary also receives water deliveries from the lake to maintain water levels for navigation and water supply. The C-44 Basin is particularly dependent on the lake for supplemental water supply and aquifer recharge. (SFWMD, 1998b).

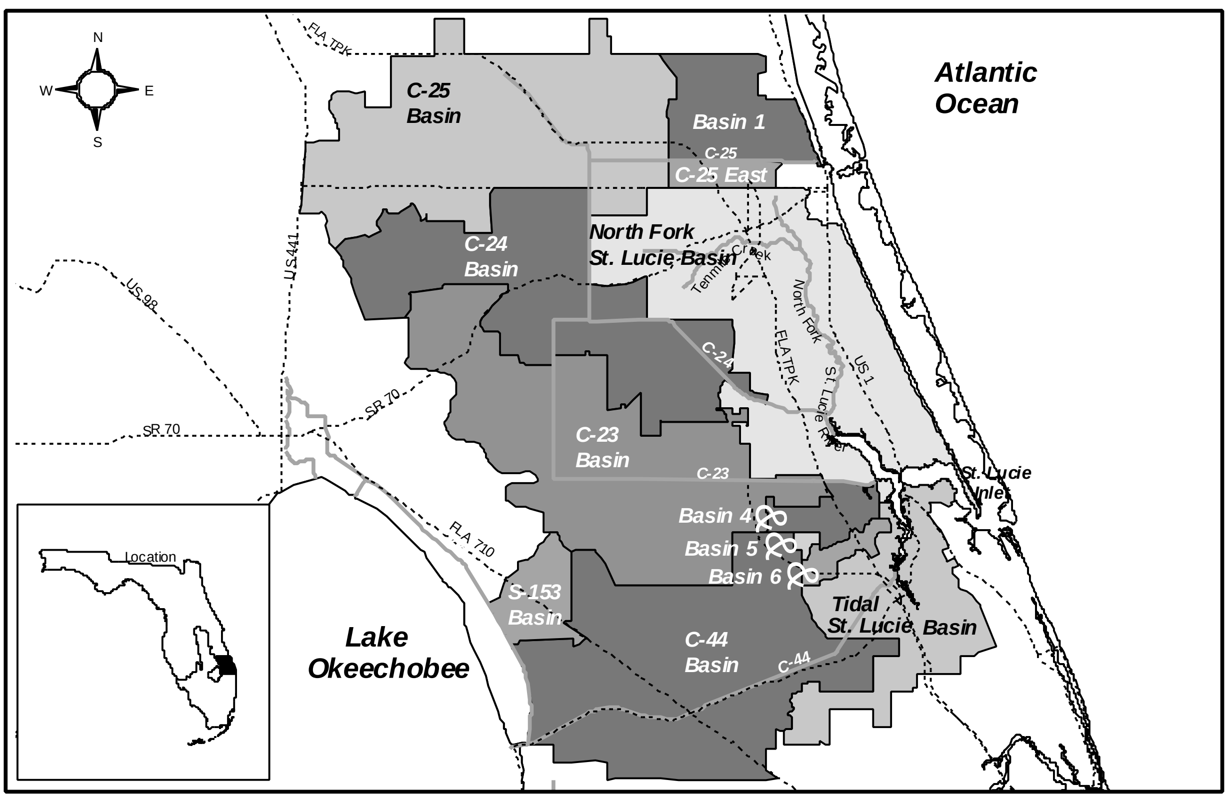


Figure 2-1. Major Drainage Basins, Rivers, and Canals in St. Lucie Watershed

CLIMATE, RAINFALL, AND SEASONAL WEATHER PATTERNS

The main components of the hydrologic cycle in the St. Lucie watershed, are precipitation, evapotranspiration, surface water inflow and outflow, and ground water flow. The climate is classified as subtropical. The average seasonal temperatures range from 64 degrees during the winter to about 81 degrees during the summer (University of Florida, 1993).

The 52-year average rainfall in the region is about 51 inches per year, but varies considerably from year to year (**Figure 2-2**). There is a wet season from May through October, and a dry season from November through April. The maximum monthly average rainfall is 7.52 inches in September (St. Lucie County) and the minimum monthly average rainfall is 1.93 inches in December (Martin County). Monthly rainfall displays a higher measure of relative variability during the dry period. Rainfall also varies aereally (from location to location), with rainfall amounts generally decreasing from east to west. About 72 percent of the annual rainfall occurs during the May through October wet season.

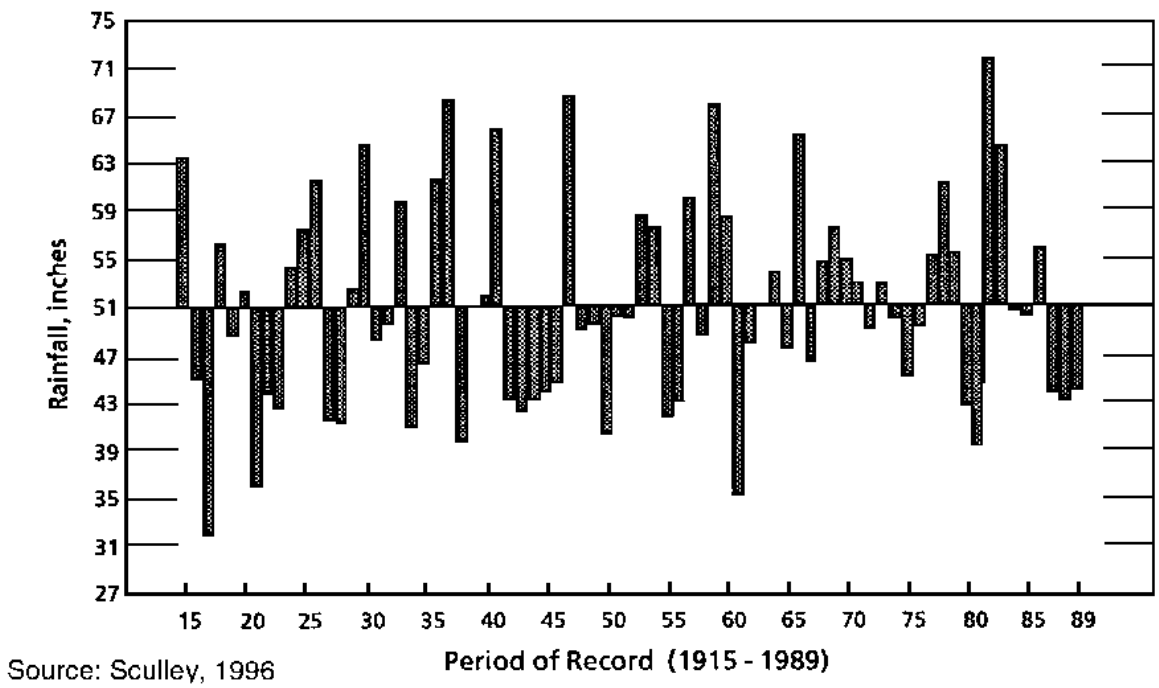


Figure 2-2. Variation from Annual Average Rainfall

Evapotranspiration (ET) is the sum of evaporation and transpiration. Like rainfall, ET is generally expressed in inches per year. Approximately 45 inches of water per year is returned to the atmosphere by evapotranspiration in South Florida. The excess of average precipitation over average ET is equal to the combined amounts of average surface water runoff and average ground water recharge.

PREDEVELOPMENT HYDROLOGY

Prior to development, most of the region was characterized by nearly level, poorly drained lands subject to frequent flooding. The natural surface drainage systems included large expanses of sloughs and marshes such as St. Johns Marsh, Allapattah Slough (also referred to as Allapattah Flats), Cane Slough, and the Savannas (**Figure 2-3**). Drainage systems with higher conveyance included the North and South Forks of the St. Lucie River, Ten Mile Creek, Five Mile Creek, and Bessey Creek. Most of these surface water systems, especially those with poor drainage, have been altered to make the land suitable for development and provide flood control.

Since the early 1900s, numerous water control facilities have been constructed to make this region suitable for agricultural, industrial, and residential use. The St. Lucie Canal (C-44) was constructed between 1916 and 1924 to provide an improved outlet for Lake Okeechobee floodwaters. From 1918 to 1919, the Fort Pierce Farms Drainage District (FPFDD) and the North St. Lucie River Drainage District (NSLRDD) were formed to provide flood control and drainage for citrus production in east-central and northeastern St. Lucie County. The C-25 Canal (also known as Belcher Canal) provided a drainage outlet for the FPFDD, as well as a limited flood protection levee. The C-24 Canal (also known as the Diversion Canal) provided drainage and limited flood protection west of the NSLRDD protection levee. The C-23 Canal provided water control in Allapattah Flats during the dry season. However, large areas continued to be under water for months at a time during the wet season.

Torrential rains and extensive flooding in South Florida in 1947 prompted the U.S. Congress to authorize the design and construction of the C&SF Project. The C&SF Project included construction of levees, canals, and spillways, pump stations and dams. Within the area that is now the Upper East Coast Planning Area. The project incorporated the existing canals and provided increased outlet capacity for Lake Okeechobee by making improvements to the St. Lucie Canal.

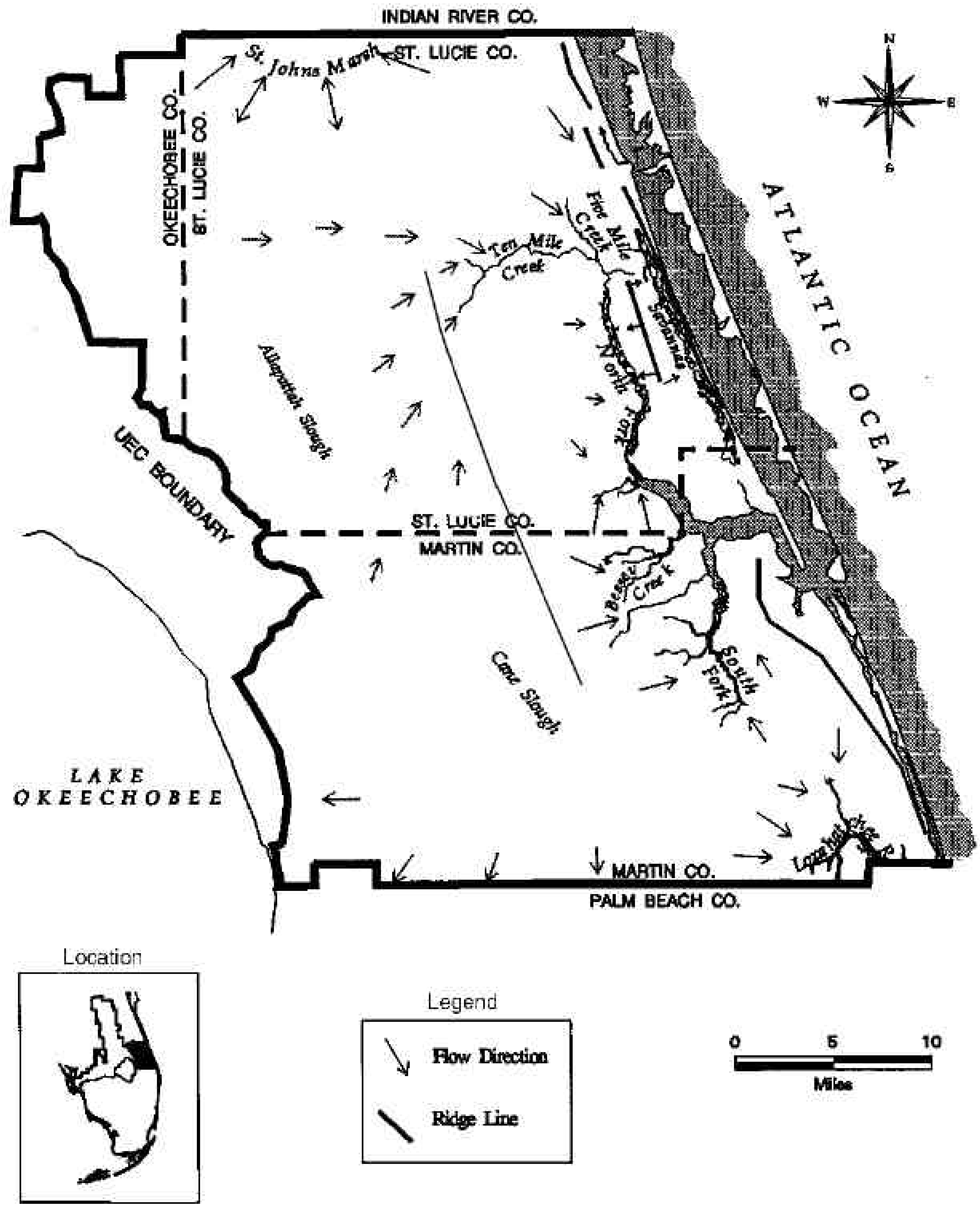


Figure 2-3. Historical Surface Water Drainage System in St. Lucie Watershed

MAJOR BASINS

St. Lucie Agricultural Area

The St. Lucie Agricultural Area is located in western St. Lucie County, eastern Okeechobee County and northern Martin County. It includes all of the C-23, C-24, C-25 basins, and parts of the North Fork St. Lucie River Basin (**Figure 2-4**).

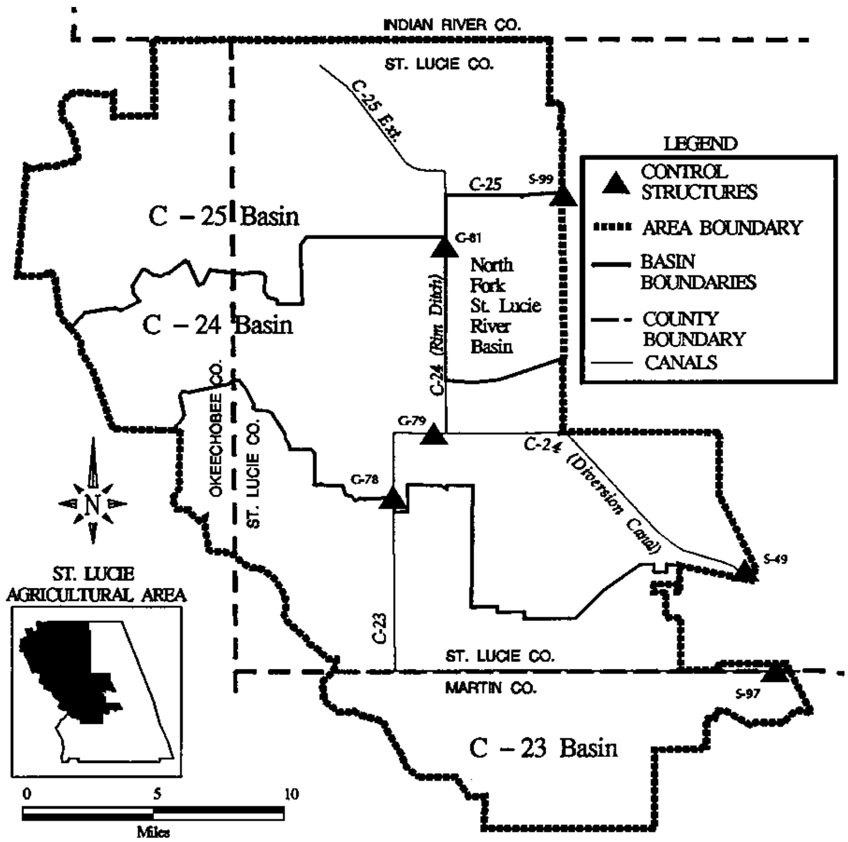


Figure 2-4. St. Lucie Agricultural Area Drainage Basins

The C-23, C-24 and C-25 canals and control structures were improved under the C&SF Project. Their current functions are: (1) to remove excess water from their respective basins; (2) to supply water during periods of low rainfall; and (3) to maintain ground water table elevations at the coastal structures to prevent saltwater intrusion.

The canals and control structures were designed to pass 30 percent of the Standard Project Flood, and to meet irrigation delivery requirements for the basin. In this planning area, a Standard Project Flood is statistically equivalent to a 10-year, 72-hour storm event. Excess water may be discharged from C-25 to tidewater by way of S-99 and S-50, or to C-24 by way of G-81.

Excess water in C-24 may be discharged to tidewater by way of S-49, to C-25 by way of G-81, or to C-23 by way of G-78. Excess water in C-23 may be discharged to tidewater by way of S-97 and S-48, or to C-24 by way of G-78 (SFWMD 1993).

Flow in each of the C&SF Project canals is regulated by their respective control structures. For flood control and drainage, water elevations in the canal are set far enough below ground surface to provide slope in the secondary drainage systems. Water supply, on the other hand, requires the water surface in the primary canal be maintained sufficiently high to prevent over-drainage. When flow in the canals is adequate, control structures are operated to maintain a headwater stage within a seasonally dependent range (**Table 2-1**).

Table 2-1. Optimal Headwater Stage for Project Canals.

Canal	Structure	Headwater Stage (ft. NGVD)	
		Wet Season*	Dry Season
C-25	S-99	19.2-20.2	21.5-22.5
C-25	S-50	>12.0	>12.0
C-24	S-49	18.5-20.2	19.5-21.2
C-23	S-97	20.5-22.2	22.2-23.2
C-23	S-48	>8.0	>8.0

*Wet season is from May 15 to October 15. Source: Cooper and Ortel, 1988

Although the primary function of the C&SF Project was for flood control and drainage, the drainage network formed by the Project canals and the secondary canals and ditches have become an important source of irrigation water and frost protection for agriculture. In general, rainfall, ground water inflow, and runoff replenish water stored in the canals.

Eastern St. Lucie Area

The Eastern St. Lucie Area includes most of the North Fork St. Lucie River Basin and all of Basin 1 (**Figure 2-5**). There are two C&SF Project canals (C-23A and C-24) in the North Fork St. Lucie River Basin. C-23A is a short section of canal in the lower reach of the North Fork of the St. Lucie River. This canal passes discharges for both the North Fork of the St. Lucie River and the C-24 Canal to the St. Lucie River Estuary. A short reach of the C-24 Canal extends from the S-49 control structure to the North Fork of the St. Lucie River, just north of C-23A. C-23A was designed to pass 30 percent of the Standard Project Flood from the North Fork St. Lucie River Basin and from the C-24 Basin.

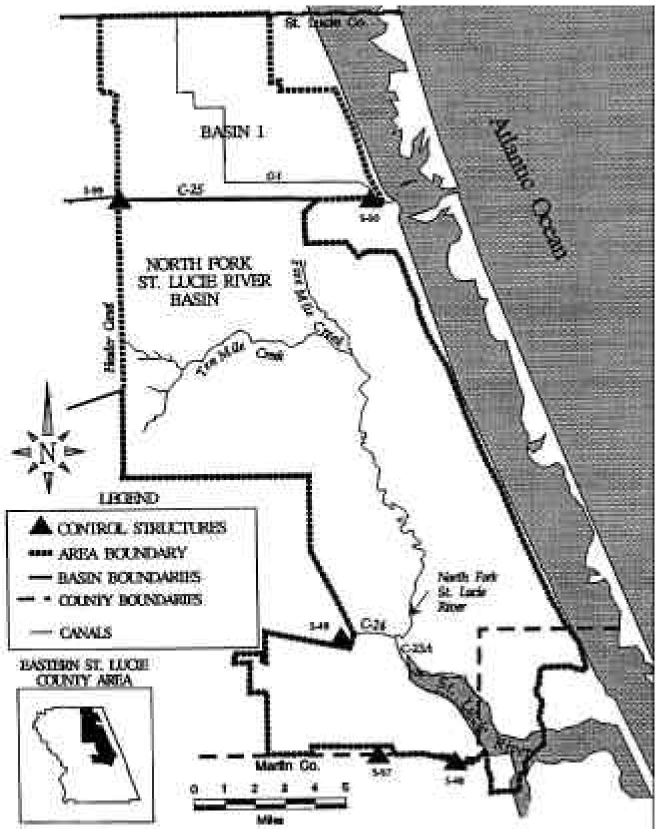


Figure 2-5. Eastern St. Lucie Area Drainage Basins

St. Lucie River Area

The St. Lucie River Area covers most of Martin County (**Figure 2-6**). Is can be subdivided in two categories: (1) the Canal Area which includes all of the C-44, S-153, and Tidal St. Lucie basins served by C&SD Project canals; and (2) basins 4, 5, 6, and 8. Basin 8 drains out of the planning area and has little interaction with the St. Lucie River Area.

The Canal Area contains the only basin (C-44 Basin) in the planning area that is hydrologically connected to Lake Okeechobee. Therefore, this section includes a discussion of the lake's regulation schedule.

Canal Area

The C&SF Project canal and control structures in the C-44 Basin have five functions: (1) to provide drainage and flood protection for the C-44 Basin; (2) to accept runoff from the S-153 Basin and discharge this runoff to tidewater; (3) to discharge water from Lake Okeechobee to tidewater when the lake is over schedule; (4) to supply water to the C-44 Basin during periods of low natural flow; and (5) to provide a navigable waterway from Lake Okeechobee to the Intracoastal Waterway. Excess water is discharged to tidewater by way of S-80 and C-44A. Under certain conditions, excess water back-flows to Lake Okeechobee by way of S-308. This happens about 50% of the time. Regulatory releases from Lake Okeechobee are made to C-44 by way of S-308. Water supply to the basin is made from Lake Okeechobee by way of S-308 and from local rainfall. Both S-80 and S-308 have navigation locks to pass boat traffic.

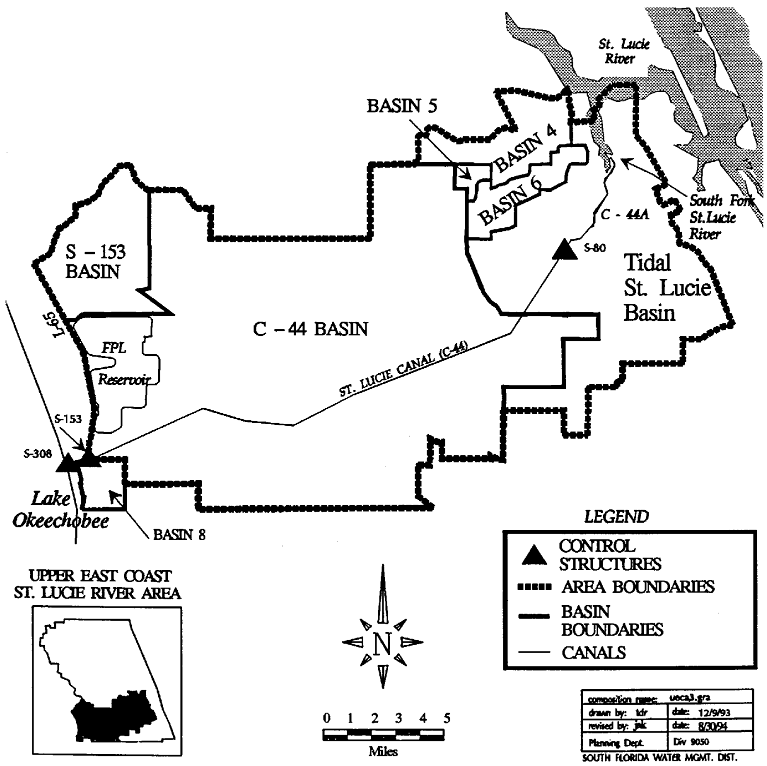


Figure 2-6. St. Lucie River Area Drainage Basins

Lockages are performed on an "on-demand" basis at S-80, except when water shortages have been declared or maintenance and repairs to the structure are taking place. Although there is no water shortage plan for S-80, the USACE will curtail lockages at the request of the District. Maintenance and repairs that result in stoppage of lockages are done on an as-needed basis, usually occurring every three to five years (SFWMD 2000b). Each lockage at S-80 releases over 1.3 million gallons of water. The average number of lockages at S-80 varies monthly. Between 1987 and 1991, there were an average of 15 lockages per day (SFWMD 2000b).

The S-153 structure provides flood protection and drainage for the S-153 Basin. Excess water in the basin is discharged to C-44 by way of the L-65 borrow canal and originally part of the S-153 Basin. This 6,600 acre reservoir is now hydraulically connected to C-44, and is considered part of the C-44 Basin. The S-153 control structure is operated to maintain an optimum stage of 18.8 feet NGVD.

The S-80 structure in the Tidal St. Lucie Basin has three functions: (1) to accept flow from C-44 and to discharge those flows to tidewater in the St. Lucie River; (2) to provide a navigable waterway from the St. Lucie Canal to the Intracoastal Waterway; and (3) to provide drainage for portions of the Tidal St. Lucie Basin.

C-44 and S-80 were designed to pass the Standard Project Flood from the C-44 Basin and the S-153 Basin and to pass regulatory discharges from Lake Okeechobee to tidewater. The S-308 and S-80 control structures are operated to maintain an optimum canal stage of 14.5 feet NGVD within the Tidal St. Lucie Basin.

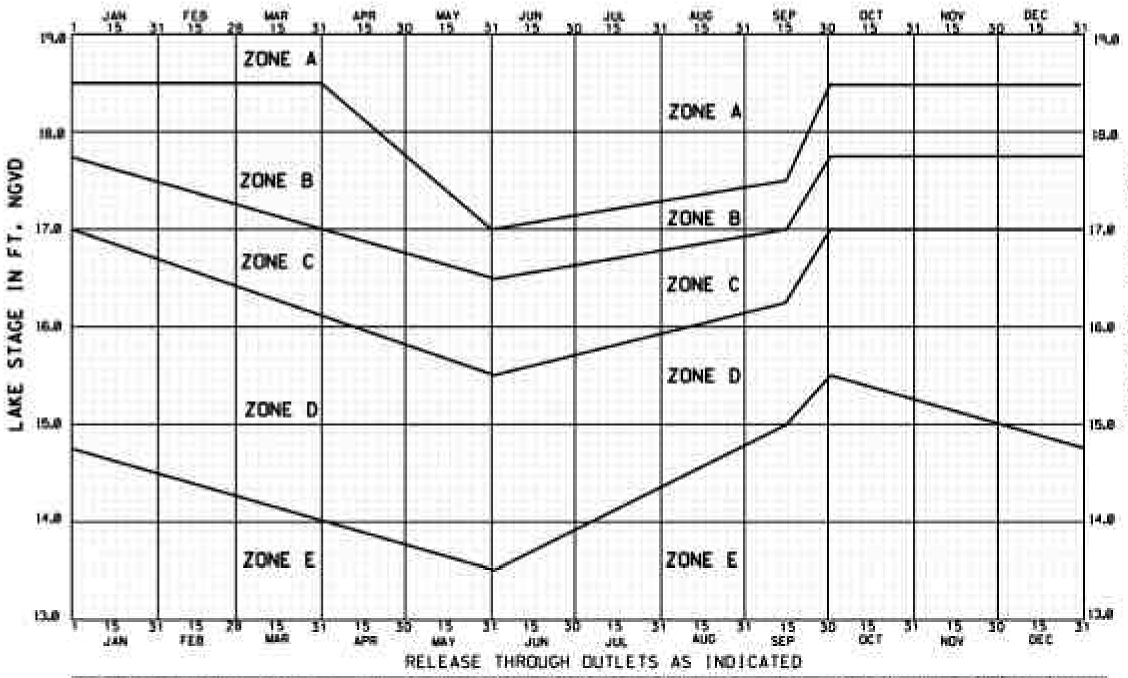
Basins 4, 5 and 6

Bessey and Danforth Creeks drain basins 4 and 6, respectively. Bessey Creek discharges to the mouth of C-23, which in turn empties into the St. Lucie River. Danforth Creek discharges to the South Fork of the St. Lucie River Estuary. Basin 5 is generally landlocked, with a poor hydraulic connection to Bessey Creek. Inadequate conveyance in the drainage systems in these basins has frequently resulted in areas of inundation in flood-prone areas.

Lake Okeechobee

Lake Okeechobee is managed as a multipurpose freshwater resource in the C&SF Project. The primary tool for managing lake water levels is the regulation schedule. This schedule defines the ranges of water levels in which specific discharges are made to control excessive accumulation of water within the lake's levee system.

The schedule varies seasonally to best meet the objectives of the C&SF Project. A number of lake regulation schedules have been adopted since the construction of the C&SF Project (see Trimble and Marban, 1988). In 1978, the USACE adopted the "15.5 – 17.5" schedule, in which regulatory releases were made if stages in the lake exceeded 15.5 – 17.5 feet NGVD. A pulse release program was added in 1991, to reduce the likelihood of making large freshwater releases to the St. Lucie and Caloosahatchee river estuaries. This schedule is commonly referred to as"Run 25". Water releases from Lake Okeechobee to the estuary currently depend on policies contained within the Water Supply and Environmental (WSE) regulation schedule (**Figure 2-7**), the amount of water stored in the Lake based on Supply-Side Management policies (Hall, 1991), and the physical constraints of release structures. The newly adopted WSE schedule for Lake Okeechobee provides additional flexibility for discretionary releases of water from the Lake for environmental benefits (USACE 2000b). In addition there are pulse releases prescribed in Zone D that lower lake stage with minimal impact to the estuary. The pulse releases consist of 10-day pulses that follow the release patterns that were designed to reflect the natural hydrology of storm water runoff. The release rate begins low on the first day and is increased to the highest release rate on the third day followed by reduced flow rates for days seven through ten. After day ten the pattern of discharge is repeated until the lake level is sufficiently lowered. The pulse releases increase from Level 1 to Level 3 as shown in **Table 2-2**. The level of release is determined by stage in Lake Okeechobee.



ZONE	AGRICULTURAL CANALS To WCAs (1,2)	CALOOSAHATCHEE RIVER AT S-77 (1,2,4)	ST. LUCIE CANAL AT S-80 (1,2,4)
A	PUMP MAXIMUM PRACTICABLE	UP TO MAXIMUM CAPACITY	UP TO MAXIMUM CAPACITY
B (3)	MAXIMUM PRACTICABLE RELEASES	RELEASES PER DECISION TREE (THESE CAN RANGE FROM MAXIMUM PULSE RELEASE UP TO MAXIMUM CAPACITY)	RELEASES PER DECISION TREE (THESE CAN RANGE FROM MAXIMUM PULSE RELEASE UP TO MAXIMUM CAPACITY)
C (3)	MAXIMUM PRACTICABLE RELEASES	RELEASES PER DECISION TREE (THESE CAN RANGE FROM NO DISCHARGE UP TO 6500 CFS)	RELEASES PER DECISION TREE (THESE CAN RANGE FROM NO DISCHARGE UP TO 3500 CFS)
D (3,5)	AS NEEDED TO MINIMIZE ADVERSE IMPACTS TO THE LITTORAL ZONE WHILE NOT ADVERSELY IMPACTING THE EVERGLADES. (SEE NOTE 5.)	RELEASES PER DECISION TREE (THESE CAN RANGE FROM NO DISCHARGE UP TO 4500 CFS)	RELEASES PER DECISION TREE (THESE CAN RANGE FROM NO DISCHARGE UP TO 2500 CFS)
E	NO REGULATORY DISCHARGE	NO REGULATORY DISCHARGE	NO REGULATORY DISCHARGE

NOTES: (1) SUBJECT TO FIRST REMOVAL OF RUNOFF FROM DOWNSTREAM BASINS
(2) GUIDELINES FOR WET, DRY AND NORMAL CONDITIONS ARE BASED ON: 1) SELECTED CLIMATIC INDICES AND TROPICAL FORECASTS AND 2) PROJECTED INFLOW CONDITIONS. RELEASES ARE SUBJECT TO THE GUIDELINES IN THE WSE OPERATIONAL DECISION TREE, PARTS 1 AND 2.
(3) RELEASES THROUGH VARIOUS OUTLETS MAY BE MODIFIED TO MINIMIZE DAMAGES OR OBTAIN ADDITIONAL BENEFITS. CONSULTATION WITH EVERGLADES AND ESTUARINE BIOLOGISTS IS ENCOURAGED TO MINIMIZE ADVERSE EFFECTS TO DOWNSTREAM ECOSYSTEMS.
(4) PULSE RELEASES ARE MADE TO MINIMIZE ADVERSE IMPACTS TO THE ESTUARIES
(5) ONLY WHEN THE WCAs ARE BELOW THEIR RESPECTIVE SCHEDULES

CENTRAL AND SOUTHERN FLORIDA
INTERIM REGULATION SCHEDULE
LAKE OKEECHOBEE

DEPARTMENT OF THE ARMY, JACKSONVILLE DISTRICT
CORPS OF ENGINEERS, JACKSONVILLE, FLORIDA
DATED: 5 NOVEMBER 1999

WSE (WITH CLIMATE OUTLOOK)

Figure 2-7. Lake Okeechobee Interim Regulation Schedule

Table 2-2. Pulse Release Schedules for the St. Lucie and Caloosahatchee River Estuaries and their Effect on Lake Okeechobee Water Levels.

Day	Daily Discharge Rate (cubic feet per second)					
	St. Lucie Level I	St. Lucie Level II	St. Lucie Level III	Caloosa. Level I	Caloosa. Level II	Caloosa. Level III
1	1,200	1,500	1,800	1,000	1,500	2,000
2	1,600	2,000	2,400	2,800	4,200	5,500
3	1,400	1,800	2,100	3,300	5,000	6,500
4	1,000	1,200	1,500	2,400	3,800	5,000
5	700	900	1,000	2,000	3,000	4,000
6	600	700	900	1,500	2,200	3,000
7	400	500	600	1,200	1,500	2,000
8	400	500	600	800	800	1,000
9	0	400	400	500	500	500
10	0	0	400	500	500	500
Acre Feet per Pulse and Correlating Lake Level Fluctuations						
AF per pulse	14,476	18,839	23,201	31,728	45,609	59,490
Impact on lake (feet)	0.03	0.04	0.05	0.07	0.10	0.13

Source: SFWMD, 1997, Lake Okeechobee SWIM Plan.

Although Lake Okeechobee is a potentially large source of water, there are competing users of this water elsewhere within the Lake Okeechobee Service area, as well as the Lower East Coast and Lower West Coast planning areas. During periods of water shortage in the lake, water supply allocations are determined through procedures described in the Lake Okeechobee Supply-Side Management Plan. This plan states that the amount of water available for use during any period is a function of the anticipated rainfall, lake evaporation, and water demands for the balance of the dry season in relation to the amount of water currently in storage.

Water availability from the lake is calculated on a weekly basis, along with a provision that allows users to borrow from their future supply to supplement existing shortfalls. The borrowing provision places the decision of risk with the user and can significantly affect the distribution of benefits among users because the amount of water borrowed is mathematically subtracted from future allocations. The Lake Okeechobee Supply-Side Management Plan is implemented if the projected lake stage falls below 11.0 feet NGVD at the end of the dry season, or below 13.5 feet NGVD at the end of the wet season (**Figure 2-8**).

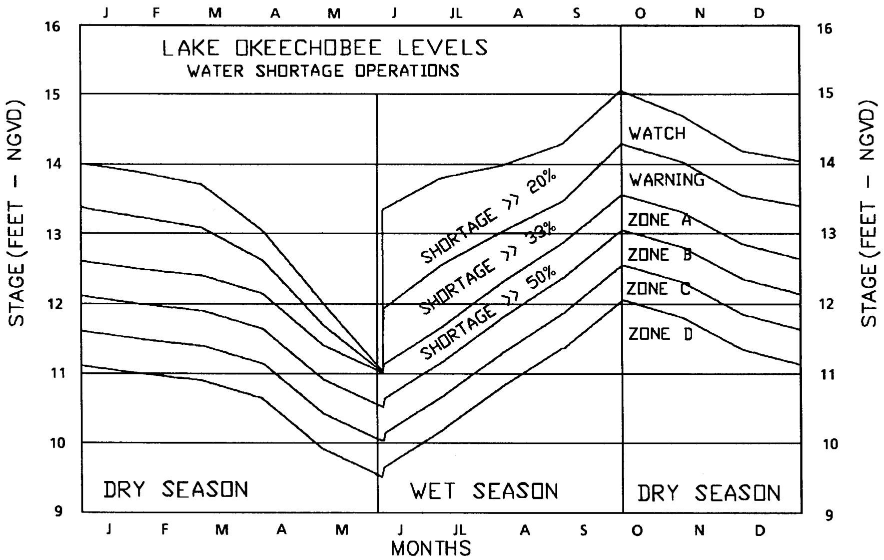


Figure 2-8. Lake Okeechobee Supply Side Management Plan

St. Lucie Estuary

The estuary is divided into three major areas (**Figure 2-9**); the inner estuary, comprised of the North and South Forks; the mid-estuary, consisting of the area from the juncture of the North and South Forks to Hell Gate, and the outer estuary extending from Hell Gate to the St. Lucie Inlet. The main body of the North Fork is about four miles long, with a surface area of approximately 4.5 mi^2 and a volume of 468.7 x 106 cubic feet. The mid-estuary extends approximately five miles from the Roosevelt Bridge to Hell Gate and has an area and volume similar to the north Fork (4.7 mi^2 and 972.7 x 106 cubic feet) (Haunert and Startzman, 1985).

The bathymetry of the Estuary has been mapped by the SFWMD (Morris, 1986). The center of the North Fork is approximately 10.0 ft. deep; depth increases to 15.0 ft. near its juncture with the South Fork. Depths within the South Fork also approach 10.0 ft. within the channel, however are generally much shallower near the Palm City Bridge. Maximum depths within the estuary are about 25.0 ft. at sites near the Roosevelt Bridge and Hell Gate. Tidal influences in the North Fork reach 15 miles north of Stuart in Five-Mile Creek, and to a water control structure on Ten-Mile Creek just west of the Florida Turnpike at Gordy Road. Tidal influences in the South Fork extend about eight miles south of Stuart to the St. Lucie Lock and Dam on the St. Lucie canal. Tidal influence also extends into the extremes of the nearby Old South Fork tributary (Morris, 1987).

Figure 2-9. St. Lucie Estuary Hydrography

Surface sediment composition within the estuary has also been mapped by the SFWMD (Haunert, 1988). Sediment composition within the SLE is influenced by hydrodynamics and is somewhat correlated to depth. Sand substrates, with little organic content, are found along the shallow shorelines of the estuary and in the St. Lucie Canal. This reflects the impacts of wave turbulence and rapid currents. Substrates comprised of mud and moderate quantities of sand are present in areas that are more typically low energy environments, but subjected to occasional high-energy events. Mud substrates are found in low energy areas such as dredged areas and the deeper portions of the estuary. These mud sediments often contain high concentrations or organic materials.

The estuarine environment is sensitive to freshwater releases, and modification of the volume, distribution, circulation, or temporal patterns of freshwater discharges can place severe stress upon the entire ecosystem. Salinity patterns affect productivity, population distribution, community composition, predator-prey relationships, and food web structure in the inshore marine habitat. In many ways, salinity is the master ecological variable that controls important aspects of community structure and food web organization in coastal system (Myers and Ewel, 1990). Other aspects of water quality, such as turbidity, dissolved oxygen content nutrient loads and toxins also affect functions of these systems (USFWS, 1990; USDA, 1989, Myers and Ewel, 1990).

Estuarine biota is well adapted to, and depends on, natural seasonal changes in salinity. The temporary storage and concurrent decrease in velocity of floodwaters within upstream wetlands aid in controlling the timing, duration, and quantity of freshwater flows into the estuary. **Upstream wetlands and their associated ground water systems, providing favorable salinities for the maintenance of base flow discharges into the estuaries, providing**

favorable salinities for estuarine biota. During the wet season, upstream wetlands provide pulses of organic detritus, which are exported downstream to the brackish water zone. These materials are an important link in the estuarine food chain.

Estuaries are important nursery grounds for many commercially important fish species. Many freshwater wetland systems in the planning area provide base flows to the estuary. Maintenance of these base flows supports the propagation of many fish species, such as snook, tarpon, seatrout and redfish, which are the basis of extensive commercial and recreational fishing industries.

LAND USE

The watershed is predominantly agricultural, especially in St. Lucie County. Urban land use is primarily located in the coastal portions of the Martin and St. Lucie areas. The highest percentage of wetlands is in Martin County (**Table 2-3**).

Based on local government comprehensive plans, urbanization is anticipated to increase in both Martin and St. Lucie counties. Agriculture has been the predominant land use in both counties and is projected to remain so in the future. However, the percentage of agricultural land use is projected to decrease as a result of urban encroachment. The most significant change in land use is the doubling of urban acreage, which reflects population growth in these two counties.

Table 2-3. Acreages and Percentages of Land Use by County

Land Use	Martin County		St. Lucie County	
	Acres	Percent	Acres	Percent
Agriculture	137,361	40	191,081	50
Urban and Transportation	50,416	15	72,500	19
Wetlands	54,116	16	33,374	9
Upland Forest	64,201	19	38,880	10
Rangeland	5,503	2	8,129	2
Barren	2,075	1	316	0
Water	26,706	8	40,612	10
Total	340,378	100	384,892	100

Source: SFWMD Florida Land Use/Land Cover GIS database, 1995.
Note: Percentages rounded to the nearest tenth.

WATER RESOURCES

Surface Water Inflow and Outflow

Essentially all surface water inflows and outflows in the planning area are derived from rainfall. The exception to this is the St. Lucie Canal (C-44), which also receives water from Lake Okeechobee. In addition, most of the flows and stages in the regions' canals are regulated for water use and flood protection. The amount of stored water is of critical importance to both the natural ecosystems and the developed areas in the region. Management of surface water storage capacity involves balancing two conflicting conditions. When there is little water in storage, drought conditions may occur during periods of deficient rainfall. Conversely, when storage is at capacity, flooding may occur due to excessive rainfall, especially during the wet season. Management of surface water systems is one of the main factors affecting movement of water through the regional hydrologic cycle.

Surface Water/Ground Water Relationships

Two vast aquifer systems, the Surficial Aquifer System (SAS) and the Floridan Aquifer System (FAS), underlie the planning area. Ground water inflows from outside the planning area form an insignificant portion of recharge to the SAS. Rainfall is the main source of recharge to the SAS, and because of this, long-term utilization of this source must be governed by local and regional recharge rates. The FAS, on the other hand, receives most of its recharge from outside of the planning area.

The construction and operation of surface water management systems affect the quantity and distribution of recharge to the SAS. Although a major source of water supply, in terms of their interaction with ground water, surface water management systems within the planning area function primarily as aquifer drains. Adams (1992) estimated that 19 percent of ground water flow in Martin County is discharged into surface water bodies, while only one percent of aquifer recharge is derived from surface water sources. Surface water management systems also impact aquifer recharge by diverting rainfall from an area before it has time to percolate down to the water table. Once diverted, this water may contribute to aquifer recharge elsewhere in the system, supply a downstream consumptive use, or it may be lost to evapotranspiration (ET) or discharged to tide.

Although the FAS is not hydraulically connected to surface water within the planning area, FAS water is usually diluted with surface water to achieve an acceptable quality for agricultural irrigation. Consequently, surface water availability for dilution purposes can be a limiting factor on the use of FAS water.

Water Supply

Water for urban and agricultural uses in the region comes from three main sources: the Floridan Aquifer System (FAS), the Surficial Aquifer System (SAS), and surface water. Surface water is used primarily for agricultural irrigation, with the FAS used as a backup source during periods of low rainfall. The SAS is the principal source for public water supply and urban irrigation. However, as the population in the planning area increases, the urban areas are anticipated to increase their use of FAS as a source of drinking water (SFWMD 2000b).

Non-environmental water assessments for 1990 and projections for 2010 were made for five categories of water use. The category of *public water supply* refers to all potable water supplied by regional water treatment facilities with pumpage greater than 500,000 gallons per day (GPD) to all types of customers, not just residential. The other four categories of water use are self-supplied. *Commercial and industrial* refers to operations using over 100,000 GPD. *Recreation self supplied* includes landscape and golf course irrigation demand. The landscape subcategory includes water used for parks, cemeteries and other irrigation applications greater than 100,000 GPD. The golf course subcategory includes those operations not supplied by a public water supply or regional reuse facility. Residential self-supplied is used to designate only those households whose primary source of water is private wells. *Agriculture* includes water used to irrigate all crops, and for cattle watering (SFWMD 2000b).

From 1990 to 2010, the total water demand is projected to increase by 34 percent (**Table 2-4**). Public water supply has the largest projected increase of 143 percent. However, agricultural water demand is projected to remain the single largest category of use. In 1990, agriculture accounted for 84 percent of the total demand. Agricultural demands are projected to increase by 23 percent by 2010, accounting for 78 percent of the total demand in that year (SFWMD 2000b).

Agricultural drainage and residential development have extensively modified the watershed of the entire St. Lucie Estuary. Major effects of these anthropogenic changes in the landscape and water management practices are increased drainage manifested by a lowered groundwater table and dramatic changes in how stormwater runoff is introduced to the Estuary. Typically, when a watershed is highly drained like the St. Lucie Estuary watershed, all three runoff factors (quality, quantity and timing) are negatively affected. From a yearly cycle perspective, the quantity of water drained to the Estuary is increased, the water quality is degraded and the seasonal distribution of runoff is altered such that dry season flows are of less magnitude and frequency and wet season flows are of greater magnitude and more frequent. From a short-term perspective, these three factors are all negatively affected due to the accelerated rate of runoff from the watershed. The vast majority of runoff occurs within the first three days instead of over an extended period of time.

Table 2-4. Overall Water Demands for 1990 and 2010 (MGY).

Category	Estimated Demands 1990	Projected Demands 2010	% Change 1990-2010
Agriculture	130,191	160,528	23
Public Water Supply	9,607	23,371	143
Residential Self Supplied	6,398	6,876	7
Commercial & Industrial	850	1,570	85
Recreation Self Supplied	7,233	13,910	92
Total	154,279	206,255	34

Source: SFWMD Upper East Coast Water Supply Plan, 2000.

Urban Water Supply Demands

Urban water demands includes: (1) public water supply (PWS) provided by utilities; (2) residential self-supplied (RSS); (3) commercial and industrial self-supplied; and (4) recreation self-supplied. Public water supply was the largest component (40%) of urban water demand in 1990; followed by recreation self supplied (30%); residential self-supply (27%), and commercial and industrial self-supply (4%). Urban water demand in 1990 was estimated to be about 24 billion gallons per year and is projected to increase to almost 46 billion gallons per year in 2010 (SFWMD 2000b).

The driving force behind urban demand is population. Population numbers for 1990 were taken from the U. S. Census. Population projections for the year 2010 were obtained from the county and local government comprehensive plans, derived from the portions of the counties within the planning area **(Table 2-5**), and used to develop urban demand projections. The total population of the planning area for 1990 is projected to increase 77 percent in 2010 (SFWMD 2000b).

Table 2.5. Population in the Upper East Coast Planning Area, 1990-2010.

Region	1990			2010		
	Total	PWS	RSS	Total	PWS	RSS
St. Lucie Area	150,171	86,808	63,364	290,100	221,320	68,780
Martin Area	100,900	54,935	45,965	154,200	101,520	52,680
Okeechobee Area	1,015	0	1,015	1,625	0	1,625
Total Planning Area	252,086	141,743	110,344	445,925	322,840	123,085

Source: Local Government Comprehensive Plans, and U.S. Bureau of the Census, 1990.

Agricultural Water Supply Demand

Agricultural water demand was estimated for 1990 to be approximately 130 billion gallons. Citrus was by far the largest agricultural water demand (82%) and is followed by sugarcane (11%). Vegetables, sod, cut flowers and ornamental nurseries combined account for about three percent of the total agricultural demand. The combined water demand for cattle watering and irrigation of improved pasture also account for about three percent (SFWMD 2000b).

Agricultural water demand is forecast to increase by 23 percent to 161 billion gallons per year in the year 2010. Approximately 95 percent of the agricultural water demand is anticipated to be for citrus (85%) and sugarcane (10%). Vegetables, sod and ornamental nurseries are each projected to represent about one percent of the total 2010 agricultural water demand (SFWMD 2000b).

The region continues to experience growth in irrigated agricultural acreage, especially citrus. The irrigated crops in this region are citrus, sugarcane, vegetables, sod, cut flowers and ornamental nursery. Growth in citrus acreage is usually on land that was formerly pasture. Pasture is seldom irrigated in the region. When irrigation does take place it is invariably in a period of extreme drought, and is done to prevent the grass from dying. There are however, some requirements for cattle watering associated with the total pasture acreage. Agricultural irrigation requirements are seasonal, especially for crops such as vegetables, which are grown only at specific times of the year (SFWMD 2000b).

WATER QUALITY

A critical relationship exists between water quality and human activity, including the withdrawal of water for supply. Increased withdrawals may cause a rise in the concentrations of impurities in the remaining water. Other human activities such as waste disposal and pollution spillage have the potential of degrading ground and surface water systems.

The St. Lucie estuary has received increased inflows over the last 100 years because of these modifications to the watershed. Extreme salinity fluctuations and ever-increasing inflows have contributed to major changes in the structure of the communities within the estuary, such as seagrass and oyster losses. Phillips (1961) described the marine plants in the SLE. At the time, mangroves were abundant in the North and South Forks and seagrasses, although stressed, were still found in many areas of the estuary. Today, the presence of seagrasses is severely limited and ephemeral. Oyster populations in the Estuary are virtually nonexistent due to the continual exposure to low salinities and lack of suitable substrate (clean hard objects) for larval re-colonization (Haunert and Startzman, 1981, 1985).

Regulatory discharges from the C-44 canal have been documented to adversely impact the SLE by depressing the salinity range far below the normal range, and by transporting large quantities of suspended materials into the estuary. Sedimentation problems in relation to C-44 discharges were recognized as early as the 1950’s (Gunter and Hall, 1963). While current monthly average flows from the watershed to the SLE seldom exceed 2500 cfs, regulatory releases from the C-44 alone have produced flows in excess of 7000 cfs. The quantity of suspended solid material passing structure S-80 has reached a peak of 8000 tons a day when daily discharges reached near 7000 cfs in 1983. Much of this material passes through the estuary and into the Indian River Lagoon or Atlantic Ocean (Haunert, 1988). It was recognized then that these discharges transported sand as well as very fine, organic rich suspended material to the estuary.

In 1969 the USGS characterized suspended sediments carried by the C-23 and C-24. It was estimated that, in 1969, these canals discharged 4,500 and 9,000 tons of sediment, respectively, to the St. Lucie estuary. These have also been characterized as very fine organic sediments (Pitt, 1972).

In 1984 the SFWMD funded the University of South Florida to study sedimentation within St. Lucie Estuary. High sedimentation rates were estimated at 0.5 to 1.0 cm per year for the past

100 years based upon historical bathymetry, and 1.0 to 2.6 cm per year based upon a radioactive dating technique (Davis and Schrader, 1984; Schrader, 1984). Recently deposited sediments were characterized as a black, organic-rich muck covered by a flocculent layer. The flocculent layer varied in thickness, with an average depth of 1.6 ft. (Schrader, 1984).

A comprehensive characterization of the St. Lucie estuary surface sediments was conducted (Haunert, 1988) which included distribution maps of sediment grain size and organic composition throughout the estuary (**Figures 2-10 and 2-11**). Portions of the St. Lucie estuary contain extremely high concentrations of organic material (muck) in sediments when compared to other similar estuarine systems. These organics, contributed from upland sources and biological die-off within the estuary, produce anaerobic conditions and toxic hydrogen sulfide within the estuary. Samples in the North Fork contain as much as 64% organics by dry weight. South Fork values are as high as 49% by dry weight. In the mid-estuary, an area of enriched sediments (20-30%) is found near the former discharge site of the Stuart Wastewater Treatment Plant (Haunert, 1988). More recent studies have confirmed the presence of a large layer of flocculent ooze within deeper portions of the St. Lucie estuary (Schropp and Taylor, 1993).

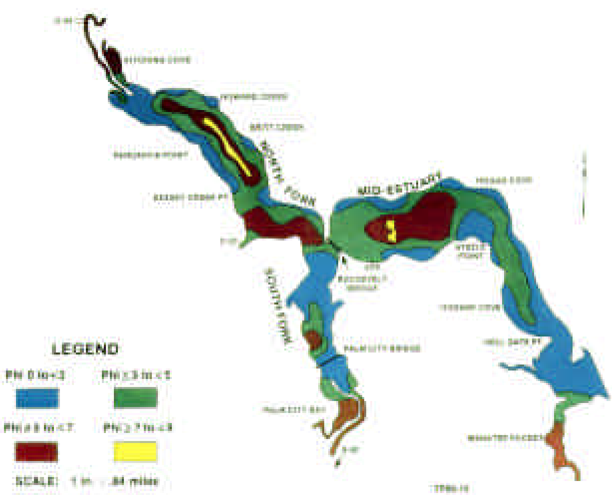


Figure 2-10. Mean Particle Size Distribution of Surface Sediments

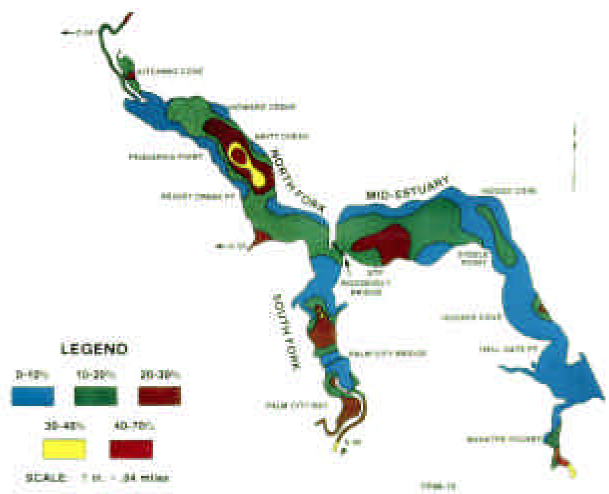


Figure 2-11. Organic Material in Surface Sediments

NATURAL SYSTEMS

Wetlands

Wetlands are present throughout the region as shown on **Figure 2-12**. Although numerous man-made impacts have altered the landscape, significant wetland systems remain in the region.

Martin County

The area now known as the Allapattah Flats (**Figure 2-3**) was historically a series of sloughs that flowed from St. Lucie County southwest into Martin County through Barley Barber Swamp and into Lake Okeechobee. Highways, railroads, and drainage projects (FPL 1988) have modified this drainage pattern. Currently, a series of isolated creeks, ponds, hammocks, sloughs and wet prairies exist within the footprint of the original Allapattah Slough (Martin County Growth Management Department, 1990).

Another large wetland system, Cane Slough (**Figure 2-3**), is located immediately west of Interstate 95. This slough flows from the northwest to southeast and is a recharge area for the headwaters of the St. Lucie River. A channelized connection exists between Cane Slough and the St. Lucie Canal. As a result of channelization and dikes, Cane Slough now consists of isolated cypress areas, ponds, and wet prairies.

The DuPuis Reserve and Pal-Mar Tract (**Figure 2-12**) also contain significant wetland systems. The 21,875 acre DuPuis Reserve is located in southwestern Martin County and northwestern Palm Beach County. This site contains numerous ponds, wet prairies, cypress domes, and remnant Everglades marsh. Management efforts are being directed toward improving wildlife habitat by restoring the hydrology of marshes and wet prairies and implementing prescribed burning and melaleuca control programs.

The 37,314 acre Pal-Mar Tract is located in Martin and Palm Beach counties. This tract is in the process of being acquired through the SOR program, Conservation and Recreation Lands (CARL) program, and Martin and Palm Beach County acquisition programs. Pal-Mar wetlands are primarily wet prairie ponds interspersed within a pine flatwood community. Despite some ditching, these wetlands are generally in good condition. The Pal-Mar SOR acquisition boundary includes a wildlife corridor which would connect Jonathan Dickinson State Park, Pal-Mar, Corbett Wildlife Management Area (in Palm Beach County), and the DuPuis Reserve.

St. Lucie County. Emergent shrub and forested wetlands once covered much of St. Lucie County. However, many of these wetlands have been extensively drained to support agricultural and urban development. The few large remaining inland wetland systems include the Savannas; wetlands associated with Five Mile, Ten Mile, Cow, Cypress, and Van Swearingen creeks; remnant portions of St. Johns Marsh; and the floodplain of the North Fork of the St. Lucie River (**Figure 2-3**).

The Savannas is a freshwater wetland system located west of the Atlantic Coastal Ridge. It is one of the most endangered natural systems in the region. Historically, the Savannas formed a continuous system, which stretched the length of the county. It was later interrupted by the drainage and development of Fort Pierce. The State of Florida under the CARL program (**Figure 2-12**) has purchased much of the system south of Fort Pierce.

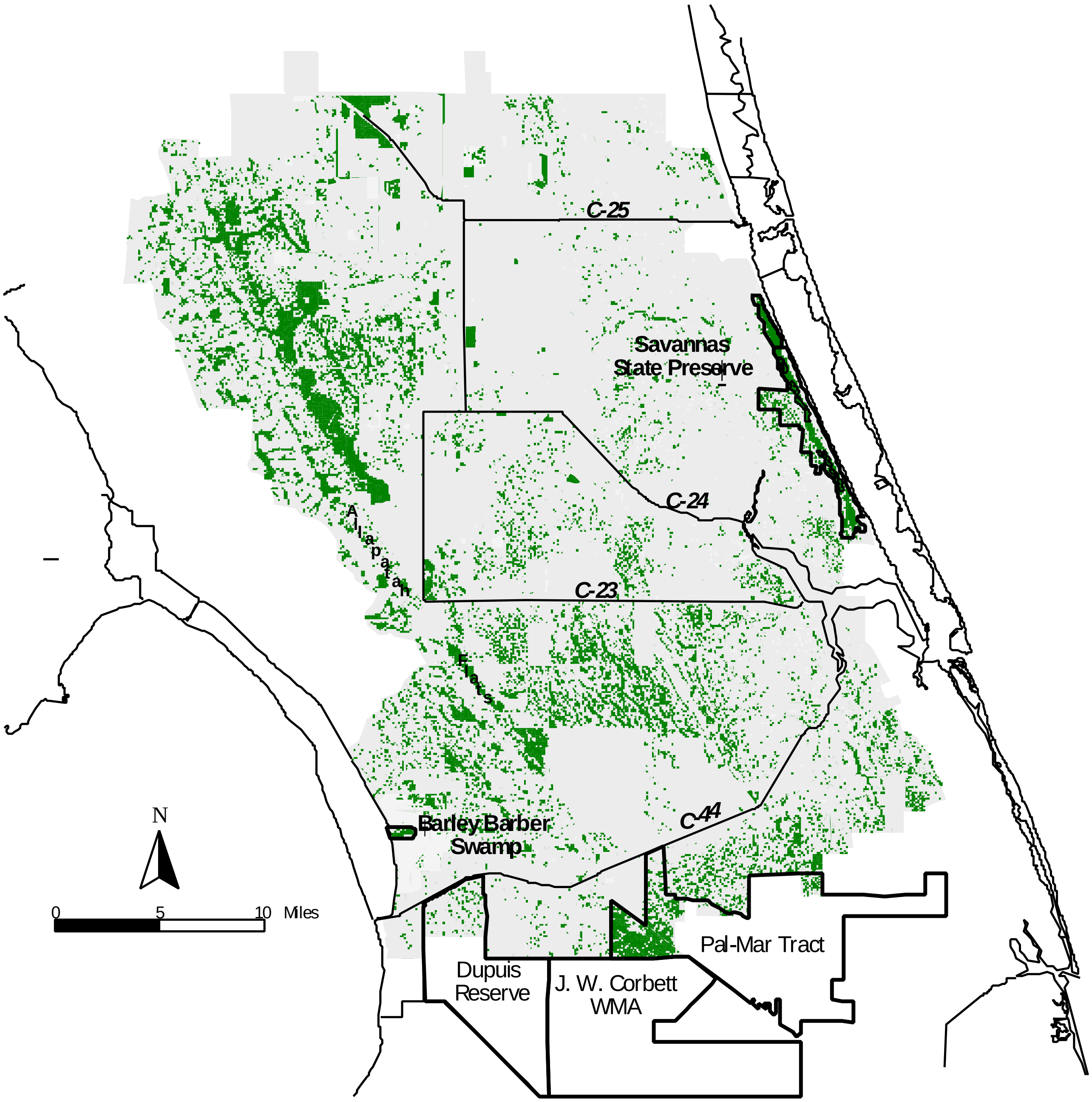


Figure 2-12. St. Lucie Watershed Wetlands and Natural Areas

Uplands

Upland plant communities in the region include pine flatwoods, scrubby flatwoods, sand pine scrub, xeric oak, and hardwood hammocks. Uplands serve as recharge areas, absorbing rainfall into soils where it is used by plants or stored underground within the aquifer. Ground water storage in upland areas reduces runoff during extreme rainfall events, while plant cover reduces erosion and absorbs nutrients and other pollutants that might be generated during a storm. Upland communities, particularly, pine flatwoods and sand pine scrub, are seriously threatened by development in the planning area.

Pine flatwoods are the dominant upland habitat within the region. These plant associations are characterized by low, flat topography and poorly drained, acidic, sandy soils. Under natural conditions, fire maintains flatwoods as a stable plant association. However, when drainage improvements and construction of roads and other fire barriers alter the natural frequency of fire, flatwoods can succeed to other community types. The nature of this succession depends on soil characteristics, hydrology, available seed sources or other local conditions (Myers and Ewel, 1990).

Xeric sand pine scrub communities, although not a diverse as pine flatwood communities, contain more endangered and threatened plants and animals than any other South Florida habitat. Most of the sand pine scrub in the planning area is associated with the one to three mile wide ancient dunes that lines along the eastern edge of the coastal ridge in Martin and St. Lucie counties.

Flora and Fauna

Southeast Florida, in general, has a rich diversity of native flora and fauna. These include endemic and sub-tropical species that cannot be found anywhere else in the United States. The St. Lucie Basin supports a diverse and abundant array of fish and wildlife species, including many endangered and threatened species (**Table 2-6**).

Table 2-6. Threatened, Endangered, and Species of Special Concern in Martin and St. Lucie Counties.

Common Name	Scientific Name	County	FGFC	FDA	USFWS
Mammals					
Florida Mouse	*Podomys floridanus*	M,S	SSC		
Florida Panther	*Felis concolor coryi*	M	E		E
Sherman's Fox Squirrel	*Scuirus niger shermani*	M,S	SSC		
Southeastern Beach Mouse	*Permyscus polionotus niveiventris*	S	T		T
West Indian Manatee	*Trichechus manatus*	M,S	E		E
Birds					
American Oystercatcher	*Haematopus palliatus*	M,S	SSC		
Arctic Peregrine Falcon	*Falco peregrinus*	M,S	E		T
Audubon's Crested Caracara	*Polyborus plancus audubonii*	M,S	T		T
Bald Eagle	*Haliaeetus leucocephalus*	M,S	T		E
Black Skimmer	*Rynchops niger*	M,S	SSC		
Brown Pelican	*Pelecanus occidentalis*	M,S	SSC		
Florida Sandhill Crane	*Grus canadenses pratensis*	M,S	T		
Florida Scrub Jay	*Aphelocoma coerulescens coerulescens*	M,S	T		T
Least Tern	*Sterna antillarum*	M,S	T		
Limpkin	*Aramus quarauna*	M,S	SSC		
Little Blue Heron	*Egretta coerulea*	M,S	SSC		
Piping Plover	*Charadrius melodus*	M,S	T		T
Red-Cockaded Woodpecker	*Picoides borealis*	M	T		E
Roseate Spoonbill	*Ajaia ajaia*	M,S	SSC		
Snail Kite	*Rostrhamus sociabilis plumbeus*	S	E		E
Snowy Egret	*Egretta thula*	M,S	SSC		
Southeastern American Kestrel	*Falco sparverius paulus*	M,S	T		
Tricolor Heron	*Egretta tricolor*	M,S	SSC		
Wood Stork	*Mycteria americana*	M,S	E		E
Reptiles					
American Alligator	*Alligator mississippiensis*	M,S	SSC		
Atlantic Green Turtle	*Chelonia mydas mydas*	M,S	E		E
Atlantic Hawksbill Turtle	*Eretmochelys imbricata imbricata*	M	E		E
Atlantic Loggerhead Turtle	*Caretta caretta caretta*	M,S	T		T
Eastern indigo Snake	*Drymarchon corais couperi*	M,S	T		T
Florida Pine Snake	*Pituophis melandeucus mugitus*	S	SSC		
Gopher Tortoise	*Gopherus polyphemus*	M,S	SSC		
Leatherback Turtle	*Dermochelys coriacea*	M,S	E		E
Plants					
Beach Star	*Remirea maritima*	M,S	T	E	
Carter's Large-flowered flax	*Linum carteri var smallii*	M		E	
Catesby's lily	*Lilium catesbaei*	M,S		T	
Curtiss' Milkweed	*Asciepias curtissii*	M,S		E	
Dollar Orchid	*Encyclia boothiana var erythroniodes*	M		E	
Florida Keys Ladies' Tresses	*Spirantes polyantha*	M		E	
Fragrant Prickly Apple	*Cereus eriophorus var fragrans*	S		E	
Hand Adder's tongue fern	*Ophioglossum palmatum*	M,S		E	
Large Flowered Rosemary	*Conradina grandiflora*	M,S		E	
Night Scent Orchid	*Epidendrum nocturnum*	M		T	
Nodding Pinweed	*Lechea cernua*	M,S		E	
Pepper	*Peperomia humilis*	M,S		E	
Pine Pinweed	*Lechea divaricata*	M		E	
Redberry ironwood	*Eugenia confusa*	M		T	
Simpson Zephyr Lily	*Sephyranthes simpsonii*	M		E	
Spotless – Petaled Baim	*Dicerandra immaculata*	S		E	
Twisted Air Plant	*Tillandsia flexuosa*	M		T	
Vanilla	*Vanilla mexicana*	M		T	
Venus Hair Fern	*Adiantum capillus-veneris*	M		T	
Wild Coco	*Pterogiossaspis ecristata*	M		T	

County: M = Martin; S = St. Lucie; Species Designation: E = Endangered; T = Threatened; SSC = Species of Special Concern.
Agencies: FGFC = Florida Game and Fresh Water Fish Commission – Jurisdictional over Florida's animals (vertebrates and invertebrates); FDA = Florida Department of Agriculture and Consumer Services – Jurisdictional over Florida's plants; USFWS = United States Fish and Wildlife Service – Jurisdictional nationally over plants and animals.
Source: The Nature Conservancy, 1990, and Florida Game and Freshwater Fish Commission, 1993.

WATER RESOURCE ISSUES

This section summarizes the major water resource issues associated with management of the St. Lucie River and Estuary as identified in a conceptual model of the system.

Conceptual Model Approach

Participants in a series of interagency workshops held from August, 1999 to November, 2000 developed the framework for a conceptual model of the St. Lucie Estuary and Indian River Lagoon (SLE/IRLCM) structured to support the applied science strategy currently being implemented in the restoration coordination and verification (RECOVER) monitoring and assessment process; a major component of the Comprehensive Everglades Restoration Plan (CERP). The SLE/IRLCM (Appendix A) identifies the major stressors in the St. Lucie watershed, the ecological and biological effects they have on the ecosystem, and the attributes in the natural systems that are the best indicators of the changes which have occurred as a result of the stressors (USACE and SFWMD,1999). The major water resource issues associated with the management of the St. Lucie watershed are discussed below.

Hydrologic Alteration of the Watershed

Due to Lake Okeechobee regulatory releases, basin flood releases, basin water withdrawals, and diversion of water from the natural river to the canals, freshwater flow distribution, volume, and timing in the St. Lucie Watershed has been altered. Hydrologic alterations effect salinity and siltation patterns resulting in major ecological impacts to every component of the estuarine ecosystem.

Altered salinity patterns affect productivity, population distribution, community composition, predator-prey relationships and the food web structure in the St. Lucie River and Estuary as evidenced by deteriorating oyster health and abundance, decline in benthic organisms, and the lack of significant submerged aquatic vegetation.

Extensive deposits of ooze and muck in the estuary are related to the transport of organic and inorganic sediments during regulatory and other high volume water releases from the canals. The ooze-covered bottom compromises oyster, fish, and benthic macroinvertebrate habitat and has resulted in an increase in pollution tolerent species. Submerged Aquatic Vegetation is also affected by the decreased light conditions resulting from siltation.

Input of Nutrients and Dissolved Organic Matter

Water quality within the St. Lucie River and estuary is threatened by altered freshwater inputs, nutrient loss from agricultural activities, anthropogenic organic compounds, trace elements, as well as stormwater runoff from developed areas. The system has experienced a 100% increase in phosphorus load and a 200% increase in nitrogen. The dramatic increase in nutrients and dissolved organics degrade water quality and may contribute to the build-up of muck. This results in changes in phytoplankton, macroalgae, and submerged aquatic vegetation communities, and creates a generally favorable habitat for primarily pollution tolerant organisms.

The increased nutrients in the St. Lucie Estuary have increased primary productivity within the system to the point that unhealthy level of dissolved oxygen occur on a regular basis in the inner estuary. The integrity of riverine and estuarine ecosystems is dependent on water quality. As water quality diminishes, so does the overall quality of the system.

Input of Toxins

The estuary has experienced increased input of toxins from agricultural run-off, urban development and the boating industry. The presence of fish abnormalities and mortality has been noted in recent years. Bioaccumulation of toxins, including metals and pesticides, in estuarine aquatic food chain may also have secondary effects on fish-eating birds and dolphins. A decline in diversity of benthic organisms and the spread of pollution-tolerant macroinvertebrates is an indicator of poor water quality in the Estuary.

Recreational Use

Population increase in this region has fueled a rapid expansion of the boating and fishing industries resulting in ecological impacts to the River and Estuary. Increased pressure from recreational fisheries has contributed to the significant decline of species such as the spotted seatrout. The increased harvest of species such as menhaden and mullet has an impact on the ecology of the St. Lucie River and Estuary.

Physical Alterations to the Estuary

Shorelines and inter-tidal areas of the estuary that were once populated by mangroves and other detritus producing vegetation now support very little vegetation. In many areas, seawalls and docks have replaced mangrove and seagrass habitats. The natural shoreline vegetation once helped stabilize the substrate, filter storm water runoff, and provide quality habitat. Further, unconsolidated sediments with high amounts of organic material have accumulated in the estuary and are frequently suspended by wave energy (Haunert, 1988). This sedimentation process has degraded habitat for bottom dwelling organisms and added to water quality problems. A significant portion of the floodplain of the North Fork St. Lucie River is completely or partially isolated from the river's main branch because of dredging conducted by the US Army Corps of Engineers during the 1920's - 40's compromising the system's nutrient filtering capability. Overall, these current conditions compromise the development of and reduce the potential for the ecosystem to sustain healthy biological communities in the estuary.

Water Supply

Prior to large scale citrus expansion in the 1960's, canal storage in St. Lucie County was adequate to meet irrigation demands. Subsequent drainage and development has depleted surface water storage while water management for flood protection has reduced groundwater storage. The Upper East Coast Water Supply Plan analysis of surface water needs estimates that, by 2020, overall water demand is projected to increase by 34 percent leading to potential water supply deficits during 1-in-10 drought conditions (SFWMD, 2000b). Annual surface water deficit estimates for a 1-in-10-drought condition and projected demands are shown in **Table 2-7**.

Unmet surface water needs were distributed to available ground water sources, primarily the Floridan Aquifer. Potential problems exist when the ground water sources cannot support the additional demands placed on them by deficits in surface water availability.

Table 2-7. Annual Surface Water Deficit Estimates for a 1-in-10 Drought Condition

	Surface Water Basin			
	C-23	**C-24**	**North Fork St. Lucie River**	**Tidal St. Lucie**
Acre-Feet	48,476	23,372	18,589	0
MGD*	43.27	20.88	16.60	0

* Determined by converting acre-feet to MG and dividing by 365

Development of water management and storage infrastructure to effectively capture and store the surface water flows in the St. Lucie Basin is proposed as part of the Upper East Coast Water Supply Plan (SFWMD, 2000b) and the Comprehensive Everglades Restoration Plan (CERP)(USACE and SFWMD 1999). With these facilities in place, the projected future (2020) surface water needs of the basin and the estuary can be met. The evaluated components, once constructed, would be adequate to meet the demands in the basin during a 1-in-10-drought event.

Need for Maximum Flow Criteria

Establishing minimum levels alone will not be sufficient to maintain a sustainable resource or protect it from significant harm. For both Lake Okeechobee and the St. Lucie Estuary, floods or extended periods of high water result in the need to release large volumes of water to the estuary for flood protection purposes. These high volume discharges have been shown to significantly impact the resource. Setting a minimum flow is viewed as a starting point to define the water needs of the estuary for sustainability. The necessary hydrologic regime for restoration of the regional ecosystem must also be defined and implemented through the use of water reservations and other water resource protection tools. Achieving the required water levels and flows through this system in an overall, long-term restoration goal of CERP and the Upper East Coast Water Supply Plan.

Maximum flows to the estuary are a concern from two sources. Maximum flows from the watershed are a major concern and are addressed in CERP. 2000 cfs. is the maximum flow desired for the estuary and this rate is frequently exceeded by watershed flows alone. Even greater flows occur due to Lake Okeechobee regulation schedule and pulse releases. The overall ability of these schedules to protect the resource is uncertain due to the limited water storage capacity of the regional system, especially during high rainfall years. As a result, new or revised minimum and maximum flow criteria are being considered for both the St. Lucie and Caloosahatchee estuaries as part of the regional water supply planning process and CERP.

RESOURCE PROTECTION PROGRAMS

Indian River Lagoon Swim Plan (IRL SWIM)

The IRL SWIM Plan, initially completed in 1989 and updated in 1994, addresses water quality concerns and environmental water supply needs by providing targets for freshwater inflows to the St. Lucie Estuary and Indian River Lagoon. Planning and research conducted under the direction of the SWIM program have resulted in the development of a salinity range restoration target for the Estuary. Related planning efforts are itemized in Appendix G.

Ten Mile Creek Project

This project is a Critical Restoration Project, which was authorized by Congress under Section 528 of the Water Resources Development Act of 1996. The intent of the Ten Mile Creek Water Preserve Area project is to attenuate wet season stormwater flows into the North Fork of the St. Lucie River from the Ten Mile Creek basin by capturing and storing stormwater. The sedimentation of suspended solids will reduce sediment loads delivered to the estuary. The captured stormwater will be passed through a polishing cell for additional water quality treatment before being released into the North Fork. Dry season discharge from the reservoir will serve the purpose of recharging local canals for irrigation, resulting in a reduced dependence on the Floridan Aquifer in this area. Construction is scheduled to begin in August, 2002.

Indian River Lagoon Feasibility Study

To address the freshwater discharges to the St. Lucie Estuary and Indian River Lagoon, the SFWMD, in cooperation with the U.S. Army Corps of Engineers (USACE), is conducting the Indian River Lagoon Restoration Feasibility Study (IRLFS) to investigate regional water resource opportunities in relation to the Central & South Florida Project canal system. Regional attenuation facilities (surface water storage areas) and Stormwater Treatment Areas (STAs) designed to capture, store, and filter local runoff in the C-23, C-24, C-25 and C-44 Basins were evaluated for their ability to attenuate flood flow to the estuary, provide water supply benefits, and provide water quality benefits to control salinity and reduce loading of nutrients, pesticides, and other pollutants contained in runoff presently discharged to the estuary. Contingent upon Congressional authorization in 2002, project construction is scheduled to begin by September, 2004.

The IRLFS refined the salinity targets established for the St. Lucie Estuary during Restudy alternative evaluations and identified an acceptable range of inflows to the estuary to meet these targets; 350 cfs to 2,000 cfs. Research conducted to establish these inflow targets for the St. Lucie Estuary provided baseline assumptions for Minimum Flow and Level technical criteria development, including the understanding that "native aquatic biodiversity depends on maintaining or creating 'some semblance' of natural flow variability, and that native species and natural communities will perish if the environment is pushed outside the range of natural variability." (Haunert and Konyha, 2001)